Factors associated with unexpected admissions and mortality among low-functioning older patients with home medical care

Running title: prognostic factors in home care

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Abstract

Aim: Need for and availability of home medical care for elderly patients with limitations in terms of access to medical facilities has been increasing. We investigated the association between low function, malnutrition, dementia, and multi-comorbidity with patient prognosis, focusing on unexpected hospital admissions and mortality in elderly non-cancer patients receiving home care.

Methods: The study included 124 Japanese patients receiving home medical care in the form of regular visits from doctors and nurses for physical and/or mental disability.

Results: Of patients studied, 36.2% experienced hospital admission. Student's *t*-test revealed that admitted patients had significantly higher Charlson Comorbidity Index scores. Meanwhile, 19.6% of patients died in the course of the study. Student's *t*-test showed that older patients had higher risk of mortality and significantly lower Activities of daily living and Mini Nutritional Assessment Short-Form scores. Cox hazard analysis showed that multi-comorbidity was a risk for unexpected hospital admission, and malnutrition was a risk for mortality in frail elderly receiving home medical care.

Conclusion: We found that multi-comorbidity was a risk for unexpected hospital admission, and malnutrition was a risk for mortality in the frail elderly receiving home medical care.

Key words: basic activities of daily life, comorbidity, dementia, hospital admission, nutrition

Introduction

The elderly population is increasing in many countries worldwide, primarily in developed countries such as Japan. This population tends to have multiple chronic diseases and to be in frail status. The frail elderly who are terminally ill often have functional limitations that make it difficult for them to access medical resources and necessary home medical care. Promotion of home medical care services in Japan has been mandated, and availability has been increasing to meet the needs of this population[1]. The objective of home medical care for the terminally ill elderly is maintaining quality of life (QOL), which sometimes is not compatible with traditional evidence-based medicine that seeks mainly to reduce mortality. Traditional evidence-based medicine cannot necessarily be applied to the frail elderly with multi-morbidities and a limited prognosis getting home medical care. Therefore, accumulating more research data in this field is warranted to consider potential approaches to the challenges of providing medical services to low-function patients who are frail and often face limitations for the duration of their lives.

Low function, malnutrition, dementia, and multi-comorbidity are the main factors involved in the frailty of older patients. Those receiving home medical care tend to have these four factors in varying degrees. These factors have been reported to be associated with poor prognosis, i.e., hospital admission or death in a variety of settings, including community dwellings and

hospitals[2,3,4,5]. A large scale study performed in Spain clearly showed that multi-comorbidity was associated with mortality in elderly dependent patients[6]. However, it is largely unknown how these four factors are associated with the prognosis in the frail elderly receiving home medical care in terminal illness.

In the current study, we investigated the association between these four factors and patient prognosis, focusing on unexpected hospital admission and mortality. Because background and prognosis were expected to be substantially different between cancer and non-cancer patients, we included only non-cancer patients in this study.

METHODS

The Nagoya Elderly with HOme MEdical (ONEHOME) study was an observational study of elderly subjects receiving home medical care[7]. Using a dataset from that study, in the current study we analyze the factors associated with mortality and hospitalization of study participants during a follow-up period. The study population included 124 Japanese patients who were receiving home medical care in the form of regular visits by doctors and nurses for a physical and/or mental disability. Cancer patients were excluded from the current study. Subjects were all

eligible for long-term care insurance[8], and were provided visiting medical care services by doctors and nurses.

The current study included the data of ONEHOME participants enrolled between 1 December 2012 and 7 January 2016. Comprehensive assessments were performed by trained nurses at baseline, and then twice per year. After subject registration, data regarding admission to a hospital and mortality were collected. Study procedures were approved by the Institutional Review Board of the Nagoya University Graduate School of Medicine. Written informed consent was obtained from all patients or, for those with substantial physician-diagnosed cognitive impairment, from a surrogate (usually the closest relative or legal guardian), as well from caregivers in the families of participating patients. Trained nurses collected the data at the participants' homes by interviewing the patient or his/her surrogate and caregiver(s), and reviewing clinical records at clinics.

Collected data included participants' economic status. Status was categorized into 4 groups: wealthy; modest; needs partial financial assistance; needs full financial assistance. Activities of daily living (ADLs) were assessed using the Barthel Index [9]. For each ADL task, participants were rated as independent (score of 2, able to perform the activity without help), partially dependent (score of 1, requiring some assistance) or completely dependent (score of 0, needing help for all activities). The ratings were based on direct observation and questioning of the patients

and family members and caregivers.

To compute the Charlson Comorbidity Index (CCI)[10], information on physician-diagnosed chronic conditions were obtained by chart review. Diagnoses included ischemic heart disease (IHD), congestive heart failure, cerebrovascular disease, diabetes mellitus, dementia, cancer (excluded from study), and neurodegenerative disorders including Parkinson's disease. In the long-term care insurance system in Japan, dementia status is categorized into 5 groups as follows: 0=no dementia, 1=very mild dementia, 2=mild dementia (needs watching by caregivers), 3=moderate dementia (difficulty in communication), 4=severe dementia, 5=severe dementia with severe behavioral and psychotic symptoms of dementia (BPSD)[8]. Mini Nutritional Assessment Short-Form (MNA®-SF) was employed for nutritional status assessment[2]. MNA-SF consists of six items: food intake, weight loss, mobility, psychological stress or acute disease, neuropsychological problems, and body mass index (BMI). The maximum score on the MNA-SF is 14. A score equal to or less than 7 is regarded as an indicator of malnutrition, and 8–11 is considered at-risk for malnutrition, while and 12–14 points or higher is an indicator of good nourishment.

Statistical analysis

Background data were compared between groups with or without unexpected admissions or death

during the observation period using Student's *t*-test. Cox hazard models were used to assess the association of each of the factors and the objective variables during the observation period. Hospital admission and death of subjects were used as objective variables. Two models were adopted for each objective variable (admission and mortality). Model 1 was adjusted for age, sex, economical status and number of cohabitants. Model 2 was further adjusted for each of the four main factors (BADL, dementia, CCI, and MNA-SF). The risk associated with a variable was expressed as a hazard ratio (HR) with a corresponding 95% confidence interval (CI).

RESULTS

Table 1 presents the characteristics of patients involved in the current study. In general, subjects were elderly, with low ADL and multiple comorbidities. A total of 36.2% of patients experienced admission. Student's *t*-test revealed that admitted patients had significantly higher CCI scores (Table 1). Specifically, heart failure and chronic obstructive pulmonary disease were more frequently found in admitted patients. Meanwhile, 19.6% of patients died in the course of the study period. Student's *t*-test revealed that deceased patients were older and had significantly lower ADL and MNA-SF scores (Table 1). The frequencies of other disease conditions were provided in supplementary table (

Cox hazard analysis adjusted for age, sex, economic status, and number of cohabitants (model 1) showed that higher CCI scores predicted admission; the results of multivariate analysis (model 1 + BADL, MNA-SF, dementia, and CCI, model 2) were similar, but CCI just missed statistical significance (Table 2). Regarding mortality, the results of model 1 and model 2 showed that lower MNA-SF scores predicted mortality (Table 3).

DISCUSSION

In this study, we found an association between nutritional status, expressed by lower MNA-SF scores, and mortality, but not with unexpected hospital admissions in elderly (non-cancer) subjects receiving home medical care. Multi-morbidity expressed by CCI was significantly associated with unexpected admissions, but not with mortality.

An Australian study reported that low MNA score predicted hospital admission in subjects with home medical care[11]. However, in that study, subjects included cancer patients and excluded those with dementia. Another study also found that malnutrition is a risk for hospitalization in general in community-dwelling elderly[12]. In the current study, MNA-SF score did not predict unexpected admission. In our study population, cancer patients were excluded, and all subjects were frail and received home medical care. Differences in subjects' backgrounds might explain

differences in the results. Kiesswetter et al. reported an association between MNA score and mortality in older adults with home medical care, which is in accordance with our results[13].

The current results indicated that non-cancer subjects with malnutrition receiving home medical care have poor prognosis. Quality of life is a top priority in the population getting home medical care with limited prognosis. Nutritional status reportedly affects QOL, but this finding is mainly from studies of cancer patients[14,15]. Such subjects require special attention for QOL issues during remaining lifespan.

CCI was originally developed to predict mortality in hospitalized subjects[10]. Indeed, a Spanish study in a cohort of dependent elderly showed that higher CCI predicted the mortality[6]. In the current study, CCI predicted unexpected hospital admission, but not mortality. Several studies have reported an association between CCI and hospitalization[16,17] in various settings. In the home medical care setting, subjects tend have multi-comorbidities. The subjects involved in the current study had generally high CCI scores (mean score 5.1±1.8), and yet CCI predicted unexpected hospital admissions. Medical providers need to keep close watch over subjects with high CCI, and to communicate with patients and caregivers for shared decision making. We found heart failure and chronic obstructive pulmonary disease more frequently in admitted group. In the current study, however, the severity of these conditions were lacked, which did not allow us to

investigate the association of the severity of specific disease and unexpected admission. Further studies would be warranted in this regard.

Several studies have reported that low BADL was associated with hospitalization or death [16,18,19, 20,21]. In the current study, we did not find an association between BADL and poor prognosis. Because ONEHOME subjects were skewed to very low BADL, this may have obscured the significance of BADL as a factor.

Dementia is a risk for poor life expectancy [4]. Subjects with dementia tend to be hospitalized for both physical and psychological problems[22]. In the current study, however, we did not find a significant association between dementia and unexpected hospitalization or death.

The ONEHOME study was conducted in an urban area in Japan. The results may have been affected by the characteristics of the area in terms of availability of medical resources, or cultural background. Although we adjusted for economic status and number of cohabitants, other confounding factors may have existed. Further study in a wider area with an increased number of subjects would be warranted to generalize the results.

Home medical care improved QOL with reduced hospitalization in non-cancer terminally ill subjects[23]. The identification of risk factors for admission and mortality would be beneficial to improve the effects of home medical care.

We recently developed the assessment scale of QOL for elderly with home medical care[24]. We are currently collecting data of QOL in ONEHOME cohort, and will investigate the factors associated with QOL in this population in near future.

In conclusion, we found that multi-comorbidity was a risk for unexpected hospital admission, and malnutrition was a risk for mortality in the frail elderly receiving home medical care.

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Conflict of interest: The authors have no conflict of interest to declare.

Ethics statement: The study followed the principals of the Declaration of Helsinki. The study was approved by the ethical committee of the Nagoya University Graduate School of Medicine (2012-0166).

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Legends

Table 1.

The patients' characteristics

Table 2

Cox hazard analysis of admission

Table 3

Cox hazard analysis of mortality

Supporting information

Supplementary table1

Frequencies of disease conditions in the subjects involved

Table 1. The patients' characteristics

	ALL	Not admitted	Admitted	p-value	Survived	Deceased	p value
Number of patinets	138	88	50		111	27	
Age	80.3±10.6	79.7±11.0	81.4±9.8	0.34	79.4±10.6	83.9±9.7	0.05
Sex (male)	57.2%(79)	53.4% (47)	6.0% (32)	0.15	57.7%(64)	55.6%(15)	0.51
BMI (Kg/m^2)	19.5±4.1	19.4±4.3	19.5±3.8	0.93	20.0±4.1	17.0±2.9	<0.001
ADL	44.3±34.5	42.7±33.9	47.2±35.7	0.46	48.2±35.2	28.1±26.6	0.02
Charlson Comorbidity Index	5.1±1.8	4.8±1.9	5.5±1.7	0.04	5.0±1.7	4.7±1.4	0.39
Dementia score	1.8±1.4	1.6±1.4	2.0±1.5	0.15	1.5±1.3	1.8±1.7	0.21
Dementia % (number)	32.6%(45)	29.5%(26)	38.0%(19)	0.35	31.5%(35)	37.0%(10)	0.65
Hypertension % (number)	40.6% (56)	42.0% (37)	38.0 % (19)	0.39	44.1% (49)	25.9% (7)	0.06
Diabetes mellitus % (number)	24.6%(34)	19.3%(17)	34.0%(17)	0.07	27.9%(31)	11.1%(3)	0.083
Heart failure % (number)	15.2%(21)	8.0%(7)	28.0%(14)	0.003	15.3%(17)	14.8%(4)	1.00
IHD % (number)	10.9% (15)	8.0% (7)	16.0% (8)	0.12	12.6% (14)	3.7% (1)	0.16
Cerebrovascular disease % (number)	34.1%(47)	36.4%(32)	30.0%(15)	0.58	36.0%(40)	25.9%(7)	0.37
COPD % (number)	17.4 % (24)	12.5% (11)	26.0% (13)	0.04	15.3% (17)	25.9% (7)	0.15
MNA-SF	7.64±3.1	7.6±3.2	7.7±2.9	0.78	8.0±2.9	7.7±2.9	0.02
Number of cohabitants	1.7±1.4	1.7±1.4	1.6±1.5	0.81	1.6±1.4	1.9±1.3	0.28
Economical status	2.1±0.9	2.0±0.8	2.1±1.0	0.64	2.0±0.8	2.1±1.0	0.64

mean ±standard deviation was expressed
BMI: Body mass index;
ADL: Activities of daily living;
IHD: ischemic heart disease
COPD: Chronic obstractive pulmonary disease
MNA-SF: Mini Nutritional AssessmentShort-Form

Table 2 Cox hazard analysis of admission

	Model 1		Model 2	
	HR	p-value	HR	p-value
BADL	1.000(0.991-1.008)	0.963	1.001(0.991-1.012)	0.851
Nutrition	0.971(0.885-1.006)	0.541	0.989(0.888-1.101)	0.834
Dementia	1.192(0.941-1.517)	0.146	1.214(0.923-1.597)	0.165
Comorbidity	1.171(1.003-1.368)	0.045	1.177(1.001-1.385)	0.049

model 1: adjusted by age, sex, economical status, number of cohabitant
model 2: mode1＋BADL, nutrition, dementia, comorbidity

Table 3 Cox hazard analysis of mortality

	Model 1		Model 2	
	HR	p-value	HR	p-value
BADL	0.993(0.979-1.008)	0.362	1.001(0.980-1.022)	0.959
Nutrition	0.838(0.713-0.986)	0.033	0.823(0.686-0.988)	0.037
Dementia	1.016(0.773-1334)	0.912	0.939(0.651-1.355)	0.737
Comorbidity	0.864(0.621-1.201)	0.383	0.822(0.511-1321)	0.418

model 1: adjusted by age, sex, economical status, number of cohabitant
model 2: mode1＋BADL, nutrition, dementia, comorbidity